CLAIMS

What is claimed is:

1. A method for imaging contrast agents, comprising:

transmitting power-modulated ultrasonic pulses comprising a predetermined transmit sequence having a plurality of transmit lines into a patient's body;

receiving a plurality of ultrasonic echoes comprising contrast-agent generated echoes and tissue-generated echoes from the patient's body;

processing the received ultrasonic echoes to generate a plurality of ultrasonic-echo signals responsive to both the contrast-agent generated and tissue-generated echoes;

processing the plurality of ultrasonic-echo signals to suppress tissue-generated echoes;

processing the plurality of ultrasonic-echo signals to suppress stationary contrast-agent generated echoes;

applying the plurality of contrast-agent generated echo signals to a color-flow algorithm to generate a plurality of data points responsive to contrast-agent motion; and

displaying the plurality of data points over time.

2. The method of claim 1, wherein processing to suppress tissue generated signals comprises applying a finite-impulse-response (FIR) filter to the received ultrasonic echoes.

3. The method of claim 1, wherein processing to suppress stationary contrast-agent generated echoes comprises applying a two-stage clutter filter to the received ultrasonic echoes.

4. The method of claim 1, wherein the plurality of data points responsive to contrast-agent motion contain information related to direction of motion and relative velocity.

5. The method of claim 1, wherein the plurality of transmit lines are generated with transmit signals having different voltage amplitudes.

6. The method of claim 1, wherein the plurality of transmit lines are generated with transmit signals having different phases.

7. The method of claim 1, wherein the plurality of transmit lines are generated with transmit signals having different polarities.

8. The method of claim 1, wherein the plurality of data points responsive to contrast-agent motion contain information related to direction of motion and relative velocity.

9. The method of claim 2, wherein a plurality of first coefficients are applied to the received ultrasonic echoes.

10. The method of claim 4, wherein displaying is performed after a determination that the intensity of the velocity information exceeds a threshold.

11. The method of claim 4, wherein displaying is performed after correcting the velocity information for tissue motion.

12. The method of claim 9, wherein a plurality of second coefficients are applied to the received ultrasonic echoes.

13. The method of claim 10, wherein B-mode image data is displayed after a determination that the intensity of the velocity information fails to meet the threshold.

14. An ultrasound-imaging system, comprising:

means for reducing tissue-generated ultrasonic echo signals;

means for reducing stationary contrast-agent generated ultrasonic-echo signals; and

means for imaging moving contrast-agent generated ultrasonic-echo signals.

15. The system of claim 14, wherein reducing tissue-generated ultrasonic echo signals comprises a power-modulation technique that uses multiple-transmit line subpackets.

16. The system of claim 14, wherein imaging comprises applying the moving contrast-agent generated ultrasonic-echo signals to a color-flow processor.

17. The system of claim 14, wherein reducing stationary contrast-agent generated ultrasonic-echo signals comprises applying a first clutter filter.

18. The system of claim 15, wherein the power-modulation technique comprises repetitively firing the multiple-transmit line subpackets.

19. The system of claim 16, wherein the color-flow processor generates information responsive to the direction and the rate of motion of moving contrast agent.

20. The system of claim 17, wherein the first clutter filter comprises a one-zero filter.

21. The system of claim 20, wherein the one-zero filter is time-shifted filter over multiple samples generated from a plurality of ultrasonic-echo signals.

22. The system of claim 21, further comprising:

means for determining tissue velocity, and

means for combining the tissue velocity with the information responsive to the direction and the rate of motion of moving-contrast agent.

23. The system of claim 22, wherein determining tissue velocity comprises applying the received ultrasonic-echo signals to a second clutter filter prior to the means for reducing tissue-generated ultrasonic-echo signals.

24. An improved ultrasound-imaging system, comprising:

an excitation-signal source configured to generate a power-modulated transmit-line sequence;

a transducer coupled to the excitation-signal source, the transducer configured to emit a plurality of ultrasonic-pulses responsive to the power-modulated transmit-line sequence into a medium and to convert a plurality of received ultrasonic echoes responsive to both tissue and one or more contrast agents within the medium to a plurality of echo signals;

an ultrasound-processing system coupled to the transducer, the ultrasound-processing system configured to reduce tissue-generated ultrasonic-echo signals and reduce stationary contrast-agent generated ultrasonic-echo signals, while passing ultrasonic-echo signals generated from moving contrast agent; and

a display-processing system coupled to the ultrasound-processing system, the display-processing system configured to receive and generate a graphic representation responsive to the ultrasonic-echo signals generated from moving contrast agent.

25. The system of claim 24, wherein the power-modulated transmit-line sequence is generated with transmit signals having different voltage amplitudes.

26. The system of claim 24, wherein the power-modulated transmit-line sequence is generated with transmit signals having different polarities.

27. The system of claim 24, wherein the power-modulated transmit-line sequence is generated with transmit signals having different phases.

28. The system of claim 24, wherein the ultrasound-processing system comprises a clutter filter.

29. The system of claim 28, wherein the ultrasound-processing system comprises a plurality of two-dimensional imaging processors.

30. The system of claim 29, wherein the ultrasound-processing system comprises a color-flow processor.

31. The system of claim 28, wherein the clutter filter comprises a multiple sample one-zero filter.

32. The system of claim 31, wherein the clutter filter time shifts the zero between adjacent ultrasonic-echo signal samples.

33. The system of claim 32, further comprising:

a tissue-velocity processor coupled to the ultrasound-processing system, the tissue-velocity processor configured to generate a first output signal responsive to motion of tissue-generated ultrasonic-echo signals;

an arbiter coupled to a second output signal from the color-flow processor and a third output signal from at least one of the plurality of two-dimensional image processors, the arbiter configured to forward the second output signal from the color-flow processor when the intensity of the second output signal exceeds a threshold; and

an arithmetic junction coupled to an output of the arbiter and the first output signal, the arithmetic junction configured to perform a subtraction of the first output signal from the second output signal.

34. The system of claim 33, wherein the arbiter is configured to forward the third output signal from at least one of the plurality of two-dimensional image processors when the intensity of the second output signal fails to exceed a threshold.